United States Environmental Protection Agency

Office of Water
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Aquatic Life Ambient Water Quality Criteria Update for Cadmium - 2016

Summary

EPA has updated its national recommended aquatic life ambient water quality criteria for cadmium in order to reflect the latest scientific information. The updated criteria account for many new laboratory aquatic toxicity tests with cadmium published since EPA's 2001 criteria document. In addition, the effect of total hardness on cadmium toxicity was also revised using the newly acquired data. The updated criteria document has undergone an external peer review that was completed in 2015 and a 60 day public comment period.

EPA's water quality criteria for cadmium provides recommendations to states and tribes authorized to establish water quality standards under the Clean Water Act.

Background

EPA published the original national recommended cadmium aquatic life criteria in 1980 with subsequent revisions in 1985, 1990, 1996 and 2001. In 1985, acute toxicity values were lowered to better protect rainbow trout, the most sensitive species. In 2001, criteria were developed for dissolved cadmium instead of total recoverable cadmium to more accurately account for bioavailability and reflect the latest EPA policy for metals risk assessment. Each update has included updated science and additional aquatic toxicity studies. EPA developed the 2016 national recommended aquatic life criteria for cadmium using the best available science.

What is Cadmium?

Cadmium is a relatively rare, naturally occurring metal found in mineral deposits and is distributed widely at low concentrations in the environment. Cadmium's primary industrial uses are manufacturers of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics. Recently cadmium has been used in manufacturing nanoparticles for use in solar cells and color displays.

How Does Cadmium Enter Surface Waters?

Cadmium enters the environment by natural and human processes, however, human sources, such as mining and urban processes, are responsible for contributing approximately 90 percent of the cadmium found in surface waters.

How Does Cadmium Affect Aquatic Life?

Cadmium is a non-essential metal with no biological function in aquatic life. Acute exposure causes increased mortality in aquatic organisms. Chronic exposure leads to adverse effects on growth, reproduction, immune and endocrine systems, development and behavior in aquatic organisms.

What are National Recommended Aquatic Life Criteria?

Ambient water quality criteria for the protection of aquatic life are numeric concentrations of pollutants in surface waters that are protective of aquatic life designated uses, with specific recommendations on the duration and frequency of those concentrations. Under Clean Water Act section 304(a), EPA is directed to develop and publish water quality criteria that reflect the latest scientific knowledge. Water quality criteria are based solely on data and scientific judgments about the relationship between pollutant concentrations and potential environmental and human health effects. EPA's recommended water

quality criteria are not rules, nor do they automatically become part of a state's water quality standards. States must adopt into their standards water quality criteria that protect the designated uses of the water bodies within their area. These can include scientifically defensible site-specific criteria that are different from EPA's national recommended criteria, as long as the site-specific criteria are protective of the designated use. Water quality criteria are not effective under the Clean Water Act until they have been adopted into state water quality standards and approved by EPA.

What Are the 2016 Recommended Water Quality Criteria for Cadmium?

EPA recommends the:

- One-hour freshwater acute criterion maximum concentration not exceed 1.8 µg/L.
- Four-day average freshwater chronic criterion magnitude not exceed 0.72 µg/L.
- One-hour estuarine/marine acute criterion maximum concentration not exceed 33 µg/L.
- Four-day average estuarine/marine chronic criterion magnitude not exceed 7.9 µg/L.

The recommended frequency of exceedance for the above is no more than once every three years.

How Do the 2016 Criteria Compare to the Previously Recommended 2001 Criteria?

The 2016 criteria reflect data for 75 new species and 49 new genera. The 2016 freshwater acute criterion (1.8 micrograms per liter) for dissolved cadmium is slightly lower than the 2001 acute criterion (2.0 micrograms per liter). The 2016 freshwater chronic criterion (0.73 micrograms per liter) for dissolved cadmium is slightly higher (less stringent) compared to the 2001 criterion (0.25 micrograms per liter). These modest changes are primarily due to the inclusion of new toxicity studies. As in the 2001 criteria, the 2016 freshwater acute criterion was derived to be protective of aquatic species and was lowered further to protect the commercially and recreationally important rainbow trout. In addition, the duration of the 2016 acute criterion was changed to one-hour. Both changes are consistent with EPA's current aquatic life criteria guidelines.

The 2016 estuarine/marine acute criterion for dissolved cadmium (33 micrograms per liter) is lower (more stringent) than the 2001 acute criterion (40 micrograms per liter), which is primarily due to the addition of new toxicity studies for sensitive genera. The 2016 estuarine/marine chronic criterion (7.9 micrograms per liter) is also slightly more stringent than the 2001 chronic criterion (8.8 micrograms per liter), due the consideration of more species in the chronic criterion development. The 2016 criteria for dissolved cadmium can be found in Table 1.

Table 1. Summary of 2016 Draft Aquatic Life AWQC for Cadmium.

	2016 AWQC Update	
	Acute (1-hour, dissolved Cd)[c]	**Chronic (4-day, dissolved Cd)**
Freshwater (Total Hardness = 100 mg/L as $CaCO_3$)[a]	1.8 µg/L[b]	0.72 µg/L
Estuarine/marine	33 µg/L	7.9 µg/L

[a] Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as $CaCO_3$ to allow the presentation of representative criteria values.

[b] Lowered to protect the commercially and recreationally important species (rainbow trout), as per the 1985 Guidelines, Stephen et al. (1985).

[c] The duration of the 2016 acute criteria was changed to 1-hour to reflect the 1985 Guidelines-based recommended acute duration.

How to View the Criteria Document and Supporting Information:

EPA has established an official public docket for this action under Docket ID No. EPA-HQ-OW-2015-0753, accessed at www.regulations.gov. You may also download the document and supporting information from EPA's aquatic life criteria website at: http://www.epa.gov/wqc/aquatic-life-criteria-cadmium

Where can I find more information?

Please contact Mike Elias by email at elias.mike@epa.gov.